

**This Page Is Inserted by IFW Operations
and is not a part of the Official Record**

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images may include (but are not limited to):

- **BLACK BORDERS**
- **TEXT CUT OFF AT TOP, BOTTOM OR SIDES**
- **FADED TEXT**
- **ILLEGIBLE TEXT**
- **SKEWED/SLANTED IMAGES**
- **COLORED PHOTOS**
- **BLACK OR VERY BLACK AND WHITE DARK PHOTOS**
- **GRAY SCALE DOCUMENTS**

IMAGES ARE BEST AVAILABLE COPY.

**As rescanning documents *will not* correct images,
please do not report the images to the
Image Problems Mailbox.**

PCT

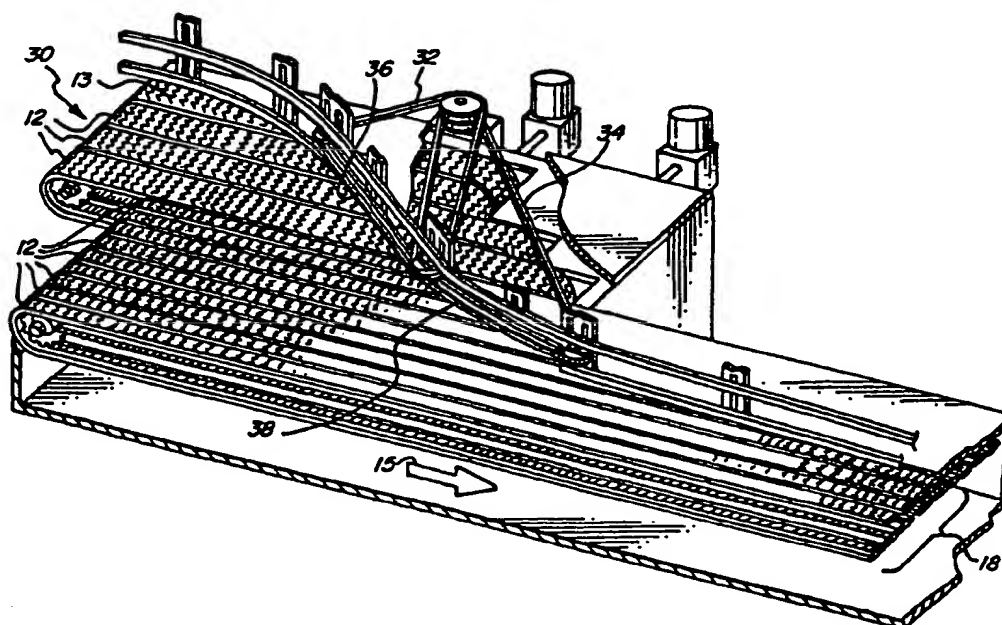
WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<p>(51) International Patent Classification ⁶ : B65G 47/68, 47/31</p>	<p>A1</p>	<p>(11) International Publication Number: WO 97/05049 (43) International Publication Date: 13 February 1997 (13.02.97)</p>
<p>(21) International Application Number: PCT/IB96/00734 (22) International Filing Date: 19 July 1996 (19.07.96) (30) Priority Data: 08/506,689 25 July 1995 (25.07.95) US (71) Applicant: SIMPLIMATIC ENGINEERING CO. [US/US]; 1320 Wards Ferry Road, P.O. Box 11709, Lynchburg, VA 24506 (US). (72) Inventor: CRAWFORD, William, Curtis; 1105 Georgetown Drive, Lynchburg, VA 24501 (US). (74) Agent: WHITMYER, Wesley, W., Jr.; St. Onge Steward Johnston & Reens L.L.C., 986 Bedford Street, Stamford, CT 06905-5619 (US).</p>		<p>(81) Designated States: AU, BR, CA, CN, JP, European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE). Published <i>With international search report.</i></p>

(54) Title: **ARTICLE COMBINER**



(57) Abstract

An article combiner has at least one moving guide belt (32, 34) disposed above multiple, parallel conveying surfaces (12) which are driven to travel at progressively increasing speeds toward the single file lane (18). The angle, speed, or both of the guide is or are selected to minimise the rotation of articles (20) which contact it.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AM	Armenia	GB	United Kingdom	MW	Malawi
AT	Austria	GE	Georgia	MX	Mexico
AU	Australia	GN	Guinea	NE	Niger
BB	Barbados	GR	Greece	NL	Netherlands
BE	Belgium	HU	Hungary	NO	Norway
BF	Burkina Faso	IE	Ireland	NZ	New Zealand
BG	Bulgaria	IT	Italy	PL	Poland
BJ	Benin	JP	Japan	PT	Portugal
BR	Brazil	KE	Kenya	RO	Romania
BY	Belarus	KG	Kyrgyzstan	RU	Russian Federation
CA	Canada	KP	Democratic People's Republic of Korea	SD	Sudan
CF	Central African Republic	KR	Republic of Korea	SE	Sweden
CG	Congo	KZ	Kazakhstan	SG	Singapore
CH	Switzerland	LI	Liechtenstein	SI	Slovenia
CI	Côte d'Ivoire	LK	Sri Lanka	SK	Slovakia
CM	Cameroon	LR	Liberia	SN	Senegal
CN	China	LT	Lithuania	SZ	Swaziland
CS	Czechoslovakia	LU	Luxembourg	TD	Chad
CZ	Czech Republic	LV	Latvia	TG	Togo
DE	Germany	MC	Monaco	TJ	Tajikistan
DK	Denmark	MD	Republic of Moldova	TT	Trinidad and Tobago
EE	Estonia	MG	Madagascar	UA	Ukraine
ES	Spain	ML	Mali	UG	Uganda
FI	Finland	MN	Mongolia	US	United States of America
FR	France	MR	Mauritania	UZ	Uzbekistan
GA	Gabon			VN	Viet Nam

"ARTICLE COMBINER"

The invention relates to an article combiner, that is to say, a conveyor system arranged for combining a mass of articles into a single file. More particularly, the invention concerns such a conveyor system having a conveyor with multiple conveying surfaces moving at increasing speeds, and a guide for moving the articles from surface to surface across the conveyor path and into a single file.

In conveyor systems for articles such as cans or bottles, it is often desired to combine a mass of articles into a single file lane. One way of accomplishing this is to provide a stationary guide above the conveying surface which is aligned at an angle with respect to the direction of travel of chains, belts or other surfaces which move at increasing speeds, to urge the articles toward the single file lane. With this type of passive system, however, the articles often become jammed at the single file lane requiring them to be cleared and possibly damaging equipment.

Jamming is frequently caused by articles which have been knocked over or "downed" during the single file combining process. Downed articles are often knocked over by the stationary guide which, in combination with the moving conveying surface, causes the articles to rotate as they are being urged towards the single-file article lane. This induced rotation can cause the articles to become unstable, spin out of control and tip over thereby jamming the conveyor. The rotation is exacerbated at points along the guide where the article is transferring from a lower speed to a higher speed belt or surface which induces rotation in the same direction as the stationary guide.

-2-

In addition to stationary guides, numerous single filing and article orienting conveyor systems include moving guides.

US Patent No. 4,252,232 to Beck and US Patent No. 5,129,504 to Smith disclose vacuum transfer belts for removing a single file of articles from the mass. ~Smith also discloses an oscillatory guide for jostling articles into a single file.

Beck and German Patent DE 3637-250-A to Nagemas both disclose systems including individual article pockets for creating the single file. In Nagemas, the pockets are formed by an auger.

US Patent No. 2,389,696 to Stiles, US Patent No. 3,592,324 to Caunt, US Patent No. 3,610,396 to Babunovic, US Patent No. 4,889,224 to Denker and German DT 23 31 781 to Wieferig also disclose conveyor systems having a single moving guide traversing a conveyor surface. The Stiles and Wieferig conveying surfaces comprise multiple belts or chains. The Stiles belts move at different speeds increasing toward the single file lane. The Babunovic and Stiles guides are designed to rotate articles on the premise that this rotation reduces or alleviates blockages.

US Patent No. 2,656,910 to Kraus, US Patent No. 2,743,807 to McKune and US Patent No. 3,601,240 to Dominici disclose devices having two moving guides for orienting/singulating articles from a single infeed conveyor.

An object of the present invention is to provide an article combiner in which the danger of toppling of the articles as they are guided towards the single file is substantially reduced.

-3-

In accordance with the invention from a first aspect there is provided a combiner for converging towards a single file a mass of articles moving longitudinally thereof, which comprises first and second adjacent
5 conveyor surfaces for the articles, the surfaces being driven to move in the same direction and at respective lower and higher speeds, and a guide traversing, and inclined to, the conveyor surfaces, the guide being driven in the sense to assist the movement, in the
10 direction from the first (lower speed) to the second (higher speed) conveyor surfaces, of articles which are being carried by the conveyor surfaces, characterised in that the articles are liable to toppling, and the guide is moved so as to reduce the rotation otherwise induced
15 by contact with the guide.

In accordance with the invention from a second aspect there is provided a combiner for combining articles from a mass to a single file comprising:

a first conveying surface circulating at a first
20 speed;

a second conveying surface circulating at a second speed greater than the first speed, said second conveying surface mounted adjacent said first conveying surface;

a first guide traversing said first and second
25 conveying surfaces at a first angle to deflect articles from said first conveying surface toward said second conveying surface;

a third conveying surface circulating at a third speed greater than the second speed, said third conveying
30 surface mounted adjacent said second conveying surface;

a second guide traversing said second and third conveying surfaces at a second angle to deflect articles

-4-

from said second conveying surface toward said third conveying surface; and

motor means arranged for moving said first guide at a first speed so as to reduce the rotation otherwise induced in the articles by contact with the said first guide, and for moving said second guide at a second speed greater than the first speed so as to reduce the rotation otherwise induced in the articles by contact with the second guide.

10 In accordance with the invention from a third aspect there is provided a combiner for combining articles from a mass to a single file comprising:

a single file lane;

15 a plurality of conveying surfaces adjacent said single file lane, each said surface circulating in a first direction at speeds increasing with proximity to said single file lane;

a guide traversing at least some of said plurality of conveying surfaces for urging articles toward said single file lane; and

20 motor means for moving said guide at a speed selected such that at an upstream end of said guide the articles rotate in one direction and at a downstream end of said guide the articles rotate in an opposite direction.

The invention and its particular features and advantages will become more apparent from the following detailed description of an article combiner in accordance with the invention, now to be described by reference to

30 the accompanying drawings. In the drawings:-

Fig.1 is a front perspective view of the combiner partially cut away to show its multiple, parallel

-5-

conveying surfaces, and having two moving guides aligned at different angles with respect to the direction of travel of the conveying surfaces;

Fig.2 is a top view of the combiner of Fig.1 showing the direction of circulation of the moving guides and the speed and direction of rotation of the articles at various points along the moving guides;

Fig.3 is an enlarged side cross section view of the combiner of Fig.1 taken along plane 3-3 in Fig.4 and showing the cross-sectional shape of the guide;

Fig.4 is an enlarged, partial front elevation view of the combiner of Fig.1 showing the region of overlap of two adjacent moving guides; and

Fig.5 is a top schematic view of a prior art combiner having a plurality of belts moving at increasing speeds toward a single file lane and a fixed guide traversing the belts toward the lane.

Referring to Fig.5, a prior art article combiner includes one or more conveying surfaces or belts which travel in the same direction but at increasing speeds from V_1 to V_2 and from V_2 to V_3 . A stationary guide rail urges the articles toward the single file article lane which travels at the highest speed V_3 . Articles which contact guide rail 14 are caused by moving conveying surfaces 12 to rotate as indicated by the arrows.

The speed of rotation of the articles 20 is a function of the speed V_1 , V_2 , V_3 of the conveying surfaces 12, the angle A_1 , A_2 , A_3 that the guide rail 14 forms with the direction of travel of the conveying surfaces 12, the mass of articles 20, and the coefficients of friction of the conveying surfaces 12 and

-6-

the guide rail 14. Generally, rotation varies proportionally with conveying surface speed V_2 , V_2 , V_3 and inversely with the angle A_2 , A_2 , A_3 to a point where the angle is small such that the frictional force between the article 20 and the guide rail 14 is insufficient to overcome the frictional resistance to rotation between the article 20 and the conveying surface 12, and/or the guide speed is substantially the same as the conveyor speed.

For example, since speed V_2 of the conveying surfaces 12 is greater than V_1 , articles 20 move along the guide rail 14 more quickly and, consequently, rotate more quickly when on the surface moving at speed V_2 . Similarly, where angle A_2 is smaller than A_2 , articles 20 move along guide rail 14 more quickly and, consequently, rotate more quickly for a given belt speed. This induced rotation of articles 20 can cause them to become unstable and tip over, causing a jam.

Referring to Figs. 1-2, a combiner 30 for combining a mass of articles into a single file in accordance with the invention is shown. Combiner 30 includes a plurality of conveying surfaces or belts 12 which circulate in direction 15. The conveying surfaces travel at speeds which generally increase in a direction toward single file lane 18. Preferably, the speeds of all of the conveying surfaces 12 increase from the outside conveying surface 13 to a single file lane 18. However, it is understood that some belts 12 may circulate at the same speed as adjacent belts so long as the speed of a belt in single file lane 18 is greater than a speed of outside belt 13.

-7-

Combiner 30 also includes moving guides 32, 34 which operate to minimise the rotation induced in the articles. Article contacting lengths 36, 38 of respective guides 32, 34 traverse conveyor belts 12 to urge articles 20 toward single file lane 18. Guides 32, 34 of the present invention are aligned at angles with respect to belts 12, and travel at speeds selected such that rotation of articles 20, that is to say, their maximum rotary speed, is minimised over the contact length of the guide belts 32, 34.

Referring to Fig.2, articles 20 on combiner 30 of the present invention are transported by conveying surfaces 12. The guide belts 32, 34 have contact lengths 36, 38 over which they may be in contact with articles 20 on the conveying surface 12. The guide belts 32, 34 move in respective first and second directions across surfaces 12 toward single file article lane 18 to urge the articles 20 towards the single file article lane 18 and to minimise induced rotation in the articles 20.

The speed and angle of the guide belts 32, 34 are set such that the rotation of articles 20 over their contact lengths 36, 38 is minimised. If the contact length 36 is linear, as depicted for guide belt 32, and the conveying surfaces 12 over which the guide belt 32 is disposed are all travelling at the same speed, then the speed of the guide belt 32 may be adjusted such that all articles 20 in contact therewith will have little or no rotation.

If the contact length of a guide belt is not linear, as depicted for guide belt 34, and/or the conveying surfaces 12 over which it is disposed are not all travelling at the same speed, then it may not be possible

-8-

to eliminate all rotation of articles 20 over the entire contact length 38 of the guide. Instead, the speed of the guide belt 34 is adjusted such that the rotation of articles over the contact length 38 thereof is minimised.

5 By "minimised" is meant that the speed of the guide belt 38 is adjusted such that, at some point, preferably near the middle of the contact length 38, articles 20 will not substantially rotate. It is understood that at an upstream end of a guide moving at the minimised speed,

10 articles 20' may rotate slightly in a direction opposite the rotation induced by a stationary guide, and that at a downstream end of a guide moving at the minimised speed, articles 20" may rotate slightly in the induced direction. At points in between the ends of such a

15 contact length, the rotation of the articles passes through zero. In this way, the rotation of articles 20 can be minimised throughout the contact length. It is understood that the number of different guide belts and the length of each contact length will vary depending

20 upon the angle at which the guide traverses the conveying surfaces, the relative speeds of the adjacent surfaces, the width of the incoming mass of articles, the level of stability required by the articles, and other factors.

Preferably, the guide belts 32, 34 are driven by a

25 common motor 40 with reducing gears 41. The guide belts 32, 34 may be lead around passive pulleys 43 with support structure 42 therebetween. Referring to Fig.4, guides 32, 34 overlap at 45 so as to provide continuous contact with articles 20 and smooth the transition between the

30 guides running at different speeds.

Referring to Fig.3, guide belts 32, 34 travel within a truncated V-shaped channel 44 connected to the support

-9-

structure 42. Guide belt 32, 34 has a truncated V-shaped outer surface 43 to conform to the channel 44 and is comprised of a material with a high coefficient of friction, such as rubber, for gripping the articles to minimise rotation. Guide belt 32 contacts article 20 below the centre of gravity 46 thereof so as to reduce the possibility of upsetting the article 20 upon contact.

The support structure 42 also supports a fixed guide rail 48 for providing added stability to the articles 20. Fixed guide 48 is set back a distance from the article and only contacts the article if it is tipping. The fixed guide rail 48 may have a covering 50 comprised of a material with a low coefficient of friction such a plastic, or teflon, or any similar material. It will be understood from Fig.1 in particular that the fixed guide rail is continued in the downstream direction of the articles so as to form them progressively into their desired single file relation.

Although the invention has been described with reference to a particular arrangement of parts, features and the like, these are not intended to exhaust all possible arrangements or features, and indeed many other modifications and variations will be ascertainable to those of skill in the art.

25

30

35

CLAIMS:

1. A combiner for converging towards a single file (18) a mass of articles (20) moving longitudinally thereof, which comprises first and second adjacent conveyor surfaces (12) for the articles, the surfaces being driven to move in the same direction and at respective lower and higher speeds, and a guide (32 or 34) traversing, and inclined to, the conveyor surfaces, the guide being driven in the sense to assist the movement, in the direction from the first (lower speed) to the second (higher speed) conveyor surfaces, of articles which are being carried by the conveyor surfaces, characterised in that the articles (20) are liable to toppling, and the guide (32 or 34) is moved so as to reduce the rotation otherwise induced by contact with the guide.

2. A combiner for combining articles (20) from a mass to a single file (18) comprising:

a first conveying surface circulating at a first speed;

a second conveying surface circulating at a second speed greater than the first speed, said second conveying surface mounted adjacent said first conveying surface;

a first guide (32) traversing said first and second conveying surfaces at a first angle to deflect articles from said first conveying surface toward said second conveying surface;

a third conveying surface circulating at a third speed greater than the second speed, said third conveying surface mounted adjacent said second conveying surface;

-11-

a second guide (34) traversing said second and third conveying surfaces at a second angle to deflect articles from said second conveying surface toward said third conveying surfaces, and

motor means (40,41) arranged for moving said first guide at a first speed so as to reduce the rotation otherwise induced in the articles (20) by contact with said first guide, and for moving said second guide at a second speed greater than the first speed so as to reduce the rotation otherwise induced in the articles (20) by contact with the second guide.

3. A combiner according to claim 2, characterised in that said first and second guides (32,34) overlap to provide a smooth transition between the first and second guide speeds.

4. A combiner according to any preceding claim, characterised in that it includes a fixed guide mounted behind the or each moving guide and arranged to contact the articles only if they tip, to prevent them from toppling over despite said movement of the or each moving guide.

5. A combiner for combining articles (20) from a mass to a single file comprising:

a single file lane (18);

a plurality of conveying surfaces (12) adjacent said single file lane, each said surface circulating in a first direction at speeds increasing with proximity to said single file lane;

-12-

a guide (32) traversing at least some of said plurality of conveying surfaces for urging articles toward said single file lane; and

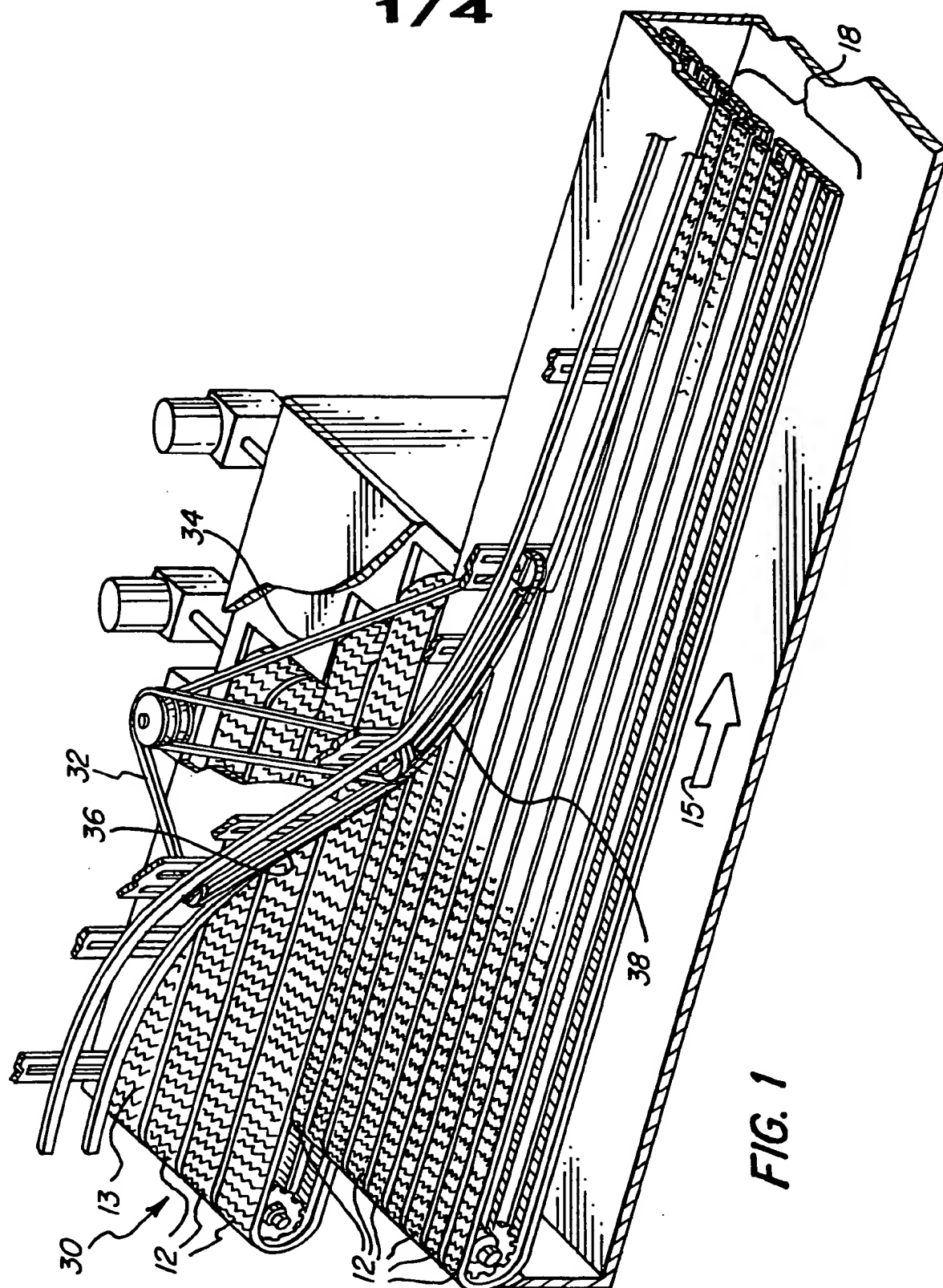
motor means (40,41) for moving said guide at a speed selected such that at an upstream end of said guide the articles rotate in one direction and at a downstream end of said guide the articles rotate in an opposite direction.

6. A combiner as claimed in claim 5, characterised by a further guide (34) traversing at least some of said plurality of conveying surfaces (12) for urging articles toward said single file lane and wherein said motor means (40,41) moves said further guide at a speed selected such that at an upstream end of said further guide the articles rotate in one direction, and at a downstream end of said further guide the articles rotate in an opposite direction.

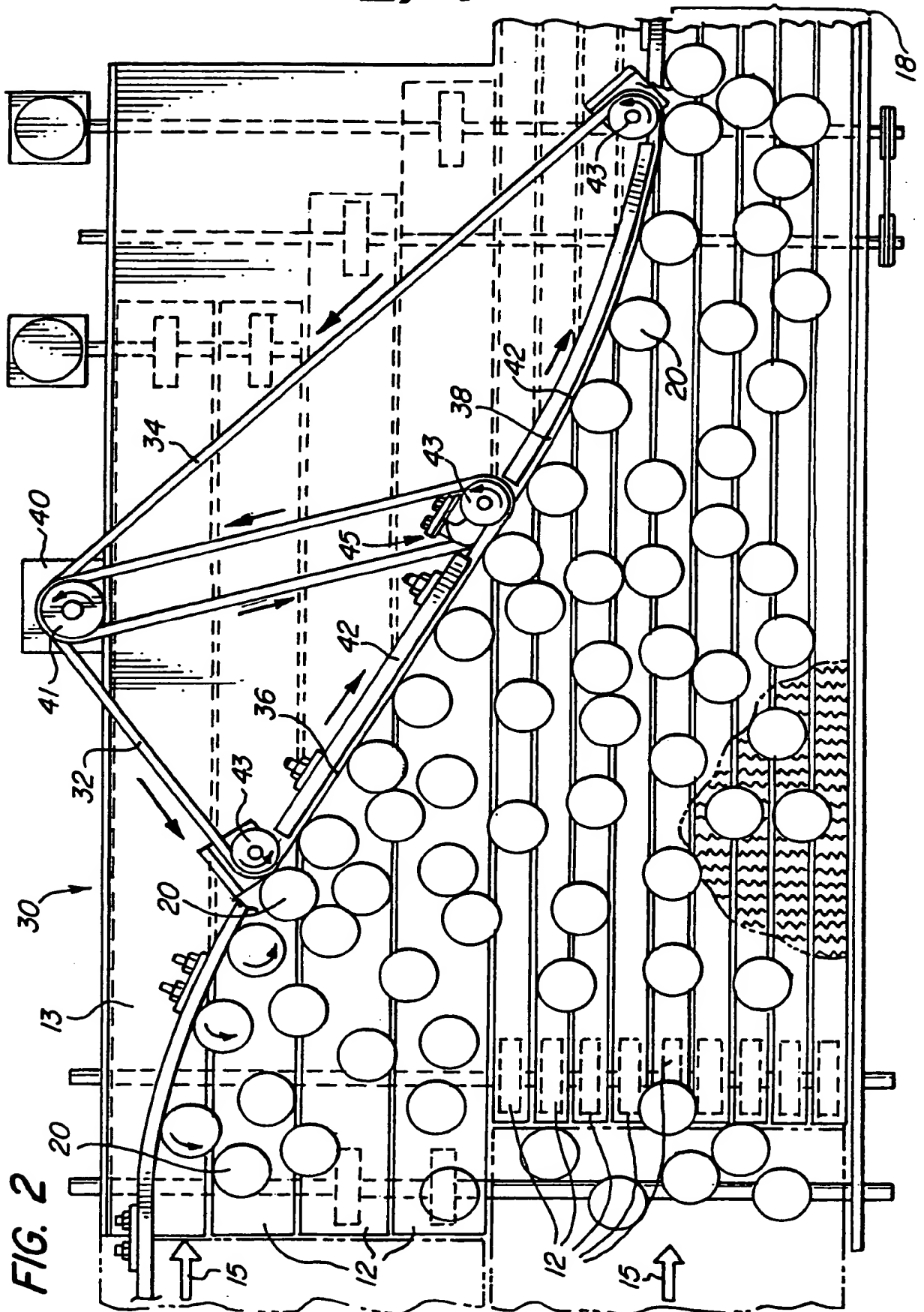
7. A combiner as claimed in claim 5 or claim 6, characterised in that the first said guide (32) and said further guide (34) traverse said conveying surfaces (12) at different angles.

8. A combiner as claimed in any claim of claims 5 to 7, characterised in that said motor means (40,41) moves the first said guide (32) and said further guide (34) at different speeds.

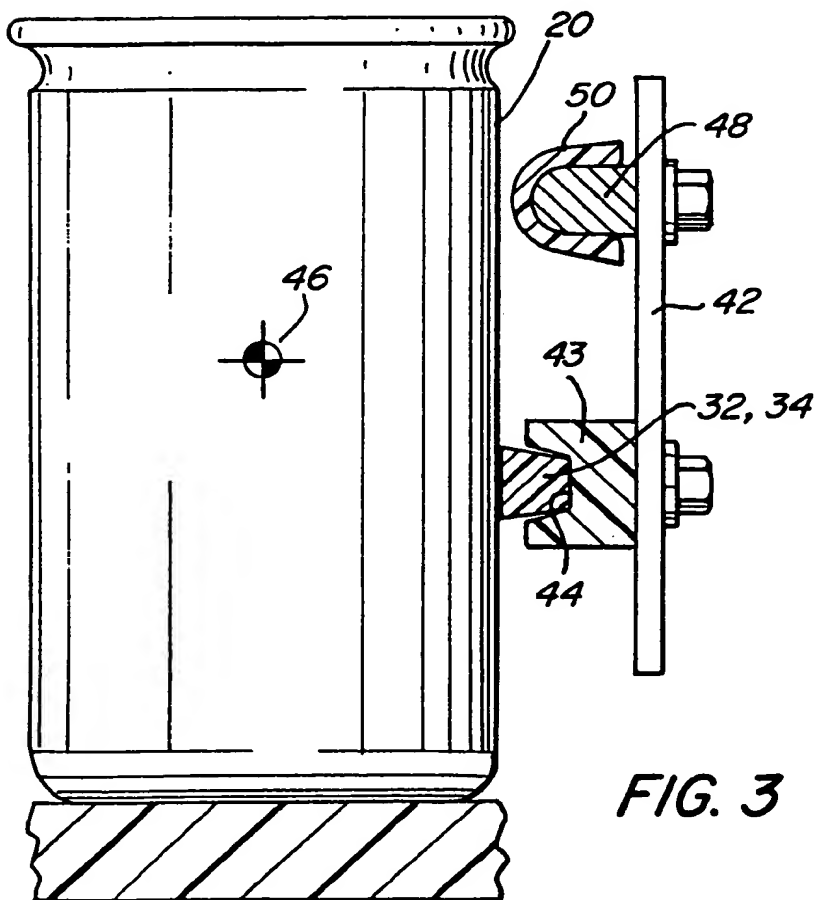
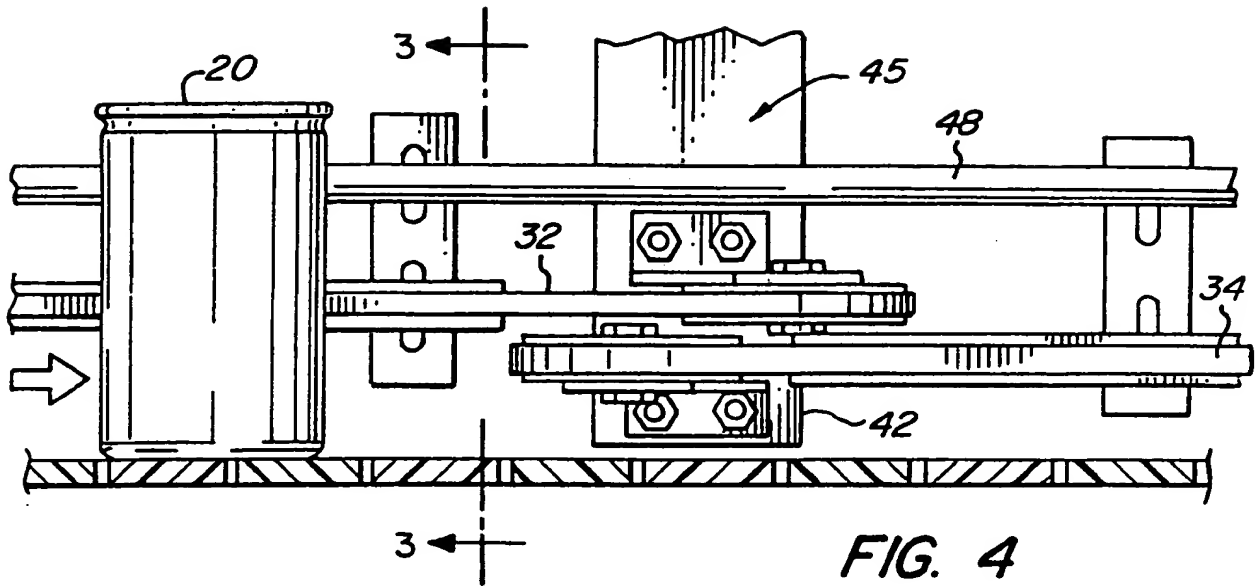
1/4



2/4



3/4



4/4

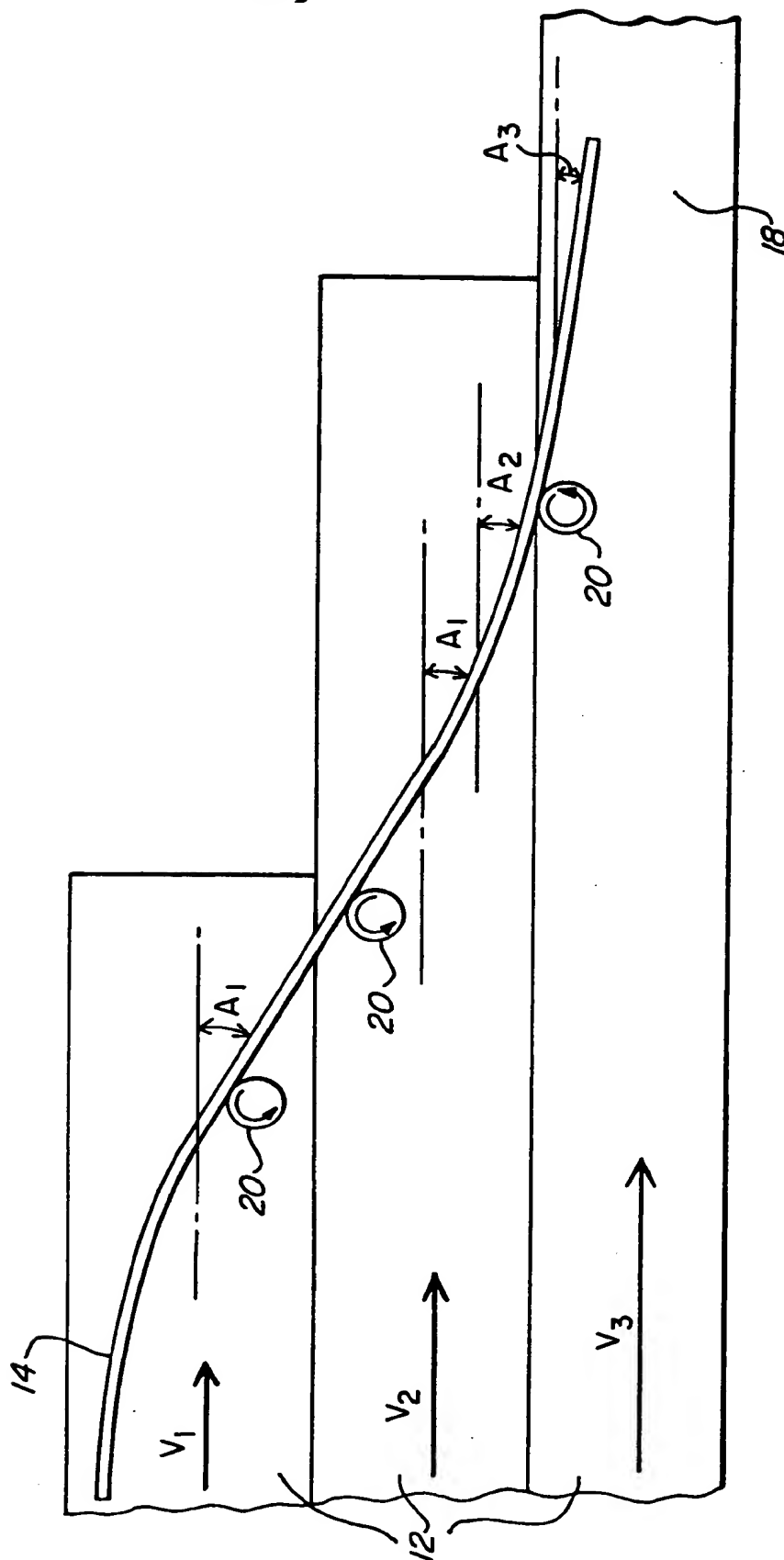


FIG. 5
(PRIOR ART)

INTERNATIONAL SEARCH REPORT

National Application No

PCT/IB 96/00734

A. CLASSIFICATION OF SUBJECT MATTER

B 65 G 47/68, 47/31

According to International Patent Classification (IPC) or to both national classification and IPC 6

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

B 65 G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE, A, 3 642 764 (VEB KOMBINAT NAGEMMA) 31 March 1988 (31.03.88), the whole document. -----	1, 2, 5

☐ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

* Special categories of cited documents :

- * "A" document defining the general state of the art which is not considered to be of particular relevance
- * "E" earlier document but published on or after the international filing date
- * "I" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- * "O" document referring to an oral disclosure, use, exhibition or other means
- * "P" document published prior to the international filing date but later than the priority date claimed

* "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

* "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

* "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

* "&" document member of the same patent family

Date of the actual completion of the international search

24 September 1996

Date of mailing of the international search report

18.10.96

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+ 31-70) 340-2040, Tx. 31 651 epo nl,
Fax (+ 31-70) 340-3016

Authorized officer

PISSENBERGER e.h.

ANHANG

zum internationalen Recherchen-
bericht über die internationale
Patentanmeldung Nr.

In diesem Anhang sind die Mitglieder
der Patentfamilien der im obenge-
nannten internationalen Recherchenbericht
angeführten Patentdokumente angegeben.
Diese Angaben dienen nur zur Unter-
richtung und erfolgen ohne Gewähr.

ANNEX

to the International Search
Report to the International Patent
Application No.

PCT/IB 96/00734 SAE 137187

This Annex lists the patent family
members relating to the patent documents
cited in the above-mentioned inter-
national search report. The Office is
in no way liable for these particulars
which are given merely for the purpose
of information.

ANNEXE

au rapport de recherche inter-
national relatif à la demande de brevet
international n°

La présente annexe indique les
membres de la famille de brevets
relatifs aux documents de brevets cités
dans le rapport de recherche inter-
national visée ci-dessus. Les renseigne-
ments fournis sont donnés à titre indica-
tif et n'engagent pas la responsabilité
de l'Office.

Im Recherchenbericht angeführtes Patentdokument Patent document cited in search report Document de brevet cité dans le rapport de recherche	Datum der Veröffentlichung Publication date Date de publication	Mitglied(er) der Patentfamilie Patent family member(s) Membre(s) de la famille de brevets	Datum der Veröffentlichung Publication date Date de publication
DE A1 3642764	31-03-88	DD A1 252809	30-12-87